PhD Open Days

Feasibility Study: Personality as a Perceptual Feature for Biosignal-Based Distress Detection (HRV derived from Clinical V-EEG).

PhD Biomedical Engineering

Tiago Teixeira de Sousa (tiago.t.de.sousa@tecnico.ulisboa.pt)

Abstract

- Psychological distress is an unpleasant emotional state characterized by a range of affective, cognitive, and somatic symptoms that deviate from an individual's normal psychological functioning [1] [2].
- Artificial intelligence (AI) technologies, such as machine learning (ML) and deep learning (DL) models, have shown promise as tools for the **identification, detection,** and **assessment** of **psychological distress** [3] [4] [5].
- Psychological distress, in **clinical environments**, significantly impacts quality of life, treatment adherence, hospitalization duration, and consequently increases healthcare costs [6] [7].
- This study aims **to validate the feasibility of identifying psychological distress in a clinical setting** (specifically, during a patient's hospitalization for V-EEG monitoring).
- Characterize the participant's **personality traits** and examine the correlation between these traits and levels of distress.
- Future ML/DL models for **distress** identification in **clinical environments** must **integrate personality traits**[8] [9].

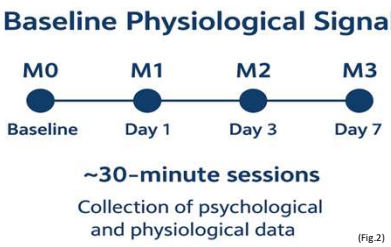
(Fig.1)
(Image AI generated-ChatGPT)

Objectives

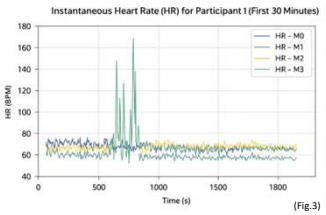
1) **Validate the technical feasibility of a multimodal approach in a clinical setting.**
2) **Generate a robust hypothesis for the development of clinical tools capable of detecting psychological distress while integrating personality traits.**

Methodology

- **Observational and longitudinal study**, one participant diagnosed with epilepsy was selected during a one-week hospitalization for V-EEG monitoring.
- **Psychological scales** (HADS – depression and anxiety, Kessler Scale – psychological distress, and NEO-FFI60 Personality Inventory) were administered at three different time points.
- **Physiological signals** (ECG, EEG, EOG, and EMG) were collected at four different time points, with the first time point (M0) serving as the baseline measurement.



(Fig.2)



(Fig.3)

Psychological Data

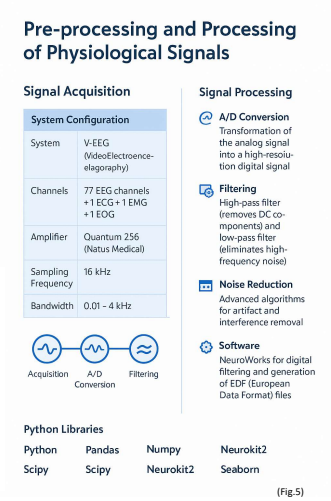
(HADS/Kessler/Neo-FFI 60)

Moment	Total HADS-A	Total HADS-D	Total HADS	Total Distress
M1	12.00	7.00	19.00	13.00
M2	5.00	1.00	6.00	18.00
M3	6.00	1.00	7.00	14.00

Neo-FFI 60

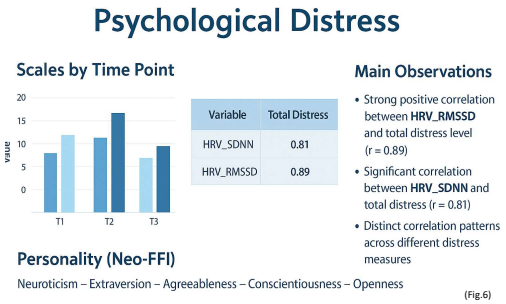
Neuroticism	Extraversion	Openness to Experience	Agreeableness
23	20	14	17
(23)	(29)	(6,3)	(32,4)

(Fig.4)



(Fig.5)

Results



(Fig.6)

Conclusion

- This case study **validates the technical feasibility of extracting HRV from V-EEG data and demonstrates a strong Distress ↔ HRV convergence in the participant.**
- **Personality traits may influence how psychological distress is perceived** and, consequently, whether and how this perception translates into changes in the autonomic nervous system (ANS) - and therefore, in HRV.

Next Steps

- **Transition from feasibility demonstration to hypothesis validation** in larger samples.
- Develop machine learning (ML) algorithms capable of **integrating personality dimensions into distress detection.**
- Create objective detection tools able **to identify psychological distress, in clinical environments,** that often escapes the subjectivity of clinical observation and self-report measures.

Acknowledgements

Data collection and methodology benefited from the direct collaboration of Carla Bentes, MD, PhD and Neurophysiology Technician Liliana Sousa, at the ULSSM EEG/Sleep Laboratory.

References: